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ABSTRACT

This paper offers reasons for using traditional quantitative research methods and illustrates some of the considerations demanding rigor in a study on gender discrimination in school-administrator salaries. Traditional quantitative methods provide a meaningful language based on numbers and objectivity, and they are less time-consuming and complex than qualitative methods. A study that investigated predictors of administrators' salaries--those of 488 associate and assistant professors and 135 assistant professors--is described. Decisions made during the research-design, data-collection, and data-analysis stages--selecting the study framework, identifying relevant variables, and deciding to use an incremental cluster regression method--are described. The study concluded that gender had a significant effect on salaries, even after consideration of all other predictors. A conclusion is that the key in making decisions about research (the design, data collection, and data analysis) is to understand what is gained or sacrificed in the rigor of the study. Besides internal and external validity, reliability, and objectivity, an additional hallmark of rigor is congruency among the study's conceptual framework, the identified problem, research questions, and methodology. (LMI)

RIGOR IN TRADITIONAL QUANTITATIVE METHODS

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Introduction

Traditional quantitative methods are often identified with four major standards of rigor: internal validity, external validity, reliability, and objectivity. Internal validity speaks to the design of the study; does the study control sources of variance (other than that of the independent variables) that might influence the dependent measures, thus leading to erroneous conclusions about the study results? External validity speaks to the generalizability of the study results --- an issue addressed largely through sampling and design. Reliability speaks to the accuracy of measurement of the independent and dependent variables --- another possible source of error in a study. (I might add that instrument validity is a parallel and equally important measurement consideration.) Lastly, objectivity can be described as the degree to which the methods are value-free; that is, do the methods employed by the researcher bias the study results in favor of the researcher's predisposition?[1]

There is one additional hallmark of rigor that I would add to the well-recognized criteria listed above --- congruency between the study's conceptual framework, the problem identified, the research questions asked, and the methods employed. Although this standard may be so obvious that it is typically assumed to be a given, too few studies exhibit particularly tight congruency between these study elements. This lack of congruency can lead, if nothing else, to confusion on the part of the researcher and the

reader in drawing conclusions from the study results.

The purpose of this presentation is two-fold: 1) to explain why I rely largely on traditional quantitative methods to conduct my research; and 2) to illustrate some of the considerations regarding rigor that I dealt with in conducting a study on gender discrimination in salaries. It is not my intent to teach you everything there is to know about rigor in quantitative methodology, for the task is far too complex and comprehensive for a single presentation. Rather, I hope to share with you some of the factors that may influence a researcher's decisions in conducting a particular study.

Why Quantitative Methods?

There are several reasons that I rely largely on traditional quantitative methods in conducting most of my research. First, I like numbers ---- they speak to me. Numbers enable me to see patterns or associations that I often cannot see as well with verbal language. I realize that this may appear to be a rather silly explanation, but it is nonetheless true for me. Given all the recent research attention given to the importance of language, discourse, metaphor and its shared or individualized meaning, I would hope that the reader can appreciate that numbers are a symbolic language that has meaning for some of us ---- often as much or more meaning than verbal language.

My reliance on numbers as a meaningful language may be explained by the fact that I have always had a reasonably strong aptitude for numbers and mathematical concepts. Further, that

aptitude was nurtured in my formal education ---- as a math major in college and as a doctoral student whose research training was influenced largely by quantitative methodologists. As a result, I am comfortable with numbers and their mathematical sentences.

Another reason that I rely largely on quantitative methods is that I have infinitely more patience for quantitative analysis than for qualitative analysis. As much as I may enjoy collecting qualitative data (e.g. through interviews), I have very little patience for the endless sorting and prioritizing tasks that are required to analyze qualitative data. In a word, it makes me crazy!

Perhaps the final reason I use quantitative methods to conduct much of my research is the objectivity that I believe it gives me. This is especially important to me because a good deal of my research addresses equity issues, including gender equity issues. Because I am female, I would not want my research to be biased in favor of women or women's issues. I feel that traditional positivist, quantitative methods grant me a degree of objectivity ---- as well as the perception of objectivity by readers ---- that other methods may not. I believe that if I follow the hallmarks of rigor associated with quantitative methods, then the numbers (the results) are more likely to be credible evidence of my findings. Because quantitative methods have some fairly explicit guidelines to enhance objectivity, my findings in equity studies may less likely be discounted due to researcher bias in data analysis and interpretation.

Addressing Rigor in the Research Process: An Illustration

Background, Limitations, and Serendipity

In 1988, my first study addressing gender discrimination in salaries of school administrators was published (see Pounder, 1988). Due to some of the limitations addressed in that study, I had decided that I wanted to do another similar piece testing the same conceptual model with a different occupational group --- professors of educational administration. As I was designing that second study, I received a survey in the mail. The survey represented a study of the educational administration professoriate conducted by McCarthy, Kuh, Newell, and Iacona et. al. (1988) in cooperation with the University Council on Educational Administration (UCEA).

As I completed my survey responses, I realized that the McCarthy et. al. instrument was measuring many of the same variables I had hoped to include in my salary study. I was at once dismayed because I felt it was unlikely that if I sent a similar survey instrument to the same population of respondents within the next two to three months that I would get a reasonable return rate. A weak return rate could limit the representativeness of my sample to the population, thus introducing a threat to the external validity as well as the internal validity of the study (sample bias).

At that point I decided to contact Dr. McCarthy and UCEA and did obtain permission to use a subset of the professoriate study data to conduct a salary discrimination study. Although I believe

I made the appropriate decision in the face of these serendipitous events, I was aware that a pre-existing data set has its limitations when adapted to a different purpose than originally intended. Some of these limitations may be remedied whereas others may not, and must be acknowledged as limitations. As my description of the research process unfolds, I will address the specific limitations imposed by the use of this pre-existing data set for the study of sex discrimination in compensation.

Study Framework

Descriptive statistics from the McCarthy et. al. data indicated that women faculty earned, on average, approximately $10,000 less per academic year than their male colleagues. When controlling for rank, the differential was approximately $5000 per academic year. Although these figures suggested gender bias in wage determination, descriptive statistics do not provide sufficient evidence of discrimination in compensation. The general model for determining salary discrimination is to estimate the portion of the salary differential attributable to relevant work, organizational, and market factors and to infer that the remaining differential is a result of discrimination in compensation (Milkovich, 1981). It is important to control (typically through sampling or through measurement and statistical control) as many relevant compensable factors as possible so that the residual attributed to gender is not inappropriately inflated, weakening the validity of the study results. The work, organizational, and market factors generally recommended for inclusion in the model

are:

A) work-related prerequisites and corequisites (e.g. education, training, experience);

B) employee work behaviors (e.g. performance, productivity, absenteeism);

C) work content and work responsibilities;

D) employing organizations and industries;

E) union membership and union characteristics;

F) labor market conditions and regions (Milkovich, 1981).

Using this framework as a guideline, a review and analysis of related literature was conducted to identify the particular types of work, organizational, and market factors that were most relevant to a study of discrimination for this particular occupational group ---- educational administration professors ---- and to discover which of these compensable factors might reasonably explain a salary differential for males and females. The reader is invited to read this review and analysis (see Pounder, 1989) for a thorough discussion of these compensable factors and their potential explanatory power for the salary disparity. Briefly, however, the factors that were most likely to covary with gender, and thus influence the salary disparity were experience and job status (rank and tenure), past administrative experience and/or the accompanying administrative salary (due to its potential effects on salary determination upon entry into the professorial role), and current administrative responsibilities (for which there is typically additional compensation).

Adequacy of Existing Data for Study Framework

Because the data revealed that there were proportionately few women at the professor rank, I decided to use only associate and assistant professors for the salary disparity study (N=488). (Nineteen percent of these respondents were female.) After examining the data set and making some recoding adjustments to more effectively utilize the data for the study of salary disparity, the following variables were available as measures of the framework's compensable factors:

A) work-related prerequisites and corequisites -

1) academic rank (associate or assistant professor)
2) tenure status (tenured or nontenured)
3) years of experience as a professor

B) employee work behaviors -

1) teaching behaviors including
   a) percentage of time spent teaching and advising students
   b) teaching load (standardized by semester)
2) service measures including
   a) percentage of time spent in service activities
   b) the sum of the number of days per month spent in various service activites (e.g. consulting, attending professional meetings, guest lecturing, editing journals)
3) research productivity measures including
   a) percentage of time spent in research and writing
   b) number of books written or edited
   c) number of articles, monographs, book chapters, and so on, written in the past five years

C) work content and work responsibilities -

1) administrative appointment (dean, assistant or associate dean, department chair, "other", or none)

D) employing organizations and industries -

1) type of institution (research, doctorate-granting, or other)

E) union membership and union characteristics -
(no available data though this variable is considered largely irrelevant to professors as an occupational group)

F) labor market conditions and regions -
(no available data)

Although the data set included measures for most of the model's compensable factors, there were some missing measures that warranted consideration as possible limitations to the study. First, an important variable identified in the analysis of the literature was past administrative experience and/or accompanying administrative salary. There was no measure of past administrative experience or its accompanying salary, either of which might influence initial salary determination upon entry into the professorship. Consequently, the inability to control this possible source of variance was identified as a limitation of the study.

Additionally, there was no measure of labor market conditions or regions. Also, there was only one organizational variable (type of institution) whereas other important organizational variables might be size, private versus public, etc. However, the omission of these variables was of less consequence in a study of discrimination because there was no reason to believe that the sex of respondents would covary with these variables. Thus, the elimination of these variables from the model could reduce the total explained variance in salary, but was unlikely to disproportionately inflate the relationship between gender and salary. Because unionism among professors is fairly rare, the

elimination of this variable from the model was not considered to be a limitation of the study.

Two other concerns with the available data existed. The first concern was that there was no measure of teaching effectiveness --- only teaching load and time spent in teaching. This is a common problem in studies of this sort because it is difficult to obtain a common measure of performance across different organizations. However, based on the review of literature, it could be assumed that the quality of teaching performance was randomly distributed across males and females with little implication for salary disparity.

The final concern was one that I had not anticipated. When examining the descriptive statistics for the study variables, I noticed that the range of responses for "number of articles, monographs, book chapters, and so on, written in the **past five years**" was unexpectedly large (0-99). Examination of these data suggested that many respondents had probably indicated the **total** number of articles that they had published, rather than those published within the past five years. The measurement error in this variable would likely attenuate its relationship with salary or other study variables.

To address this problem, I decided that I would do two sets of parallel analyses with the study data ---- one with associate and assistant professors as originally suggested (N=488) and another with assistant professors only (N=135). By analyzing the data with assistant professors only, the measurement error in this variable

would be significantly reduced because their last five years of article publications was largely the same as their total article publication record. An additional advantage was that there were proportionately more females among assistant professors (36%). However, a trade-off was that using this second sub-sample (assistant professors only) would restrict the range of the work-related prerequisite and corequisite variables, thus attenuating their relationship to salary or other study variables.

In sum, the only missing variable that could likely affect the sex discrimination question was the past administrative experience and/or accompanying salary. The omission of the remaining variables identified above was unlikely to influence the results of the primary question of the study, although their omission could reduce the total explained salary variance.

Data Analysis and Results

In the interest of brevity, only highlights of the study analysis and results are presented here. However, the reader is encouraged to read the published study article (see Pounder, 1989) for a thorough explanation of the analysis and results. Using forward regression analysis, both the sample of associate and assistant professors as well as the sample of assistant professors only revealed a significant sex effect on salaries. Further, the slopes of the regression lines suggested that the salary differential due to sex discrimination in both samples was slightly over $3000 per academic year.

It is important to examine more closely, however, one

particular portion of the data analysis. As I mentioned earlier, I consider one of the hallmarks of rigorous research to be the congruency between the study's conceptual framework, the problem identified, the research questions asked, and the methods employed. In conducting the regression analysis, I stumbled across a regression method in the SPSS manual (Statistical Package for the Social Sciences) with which I was not familiar, but which appeared to be an excellent "fit" for my study's framework. The method, simply referred to as "Test" in the manual, was a method for conducting regression analysis using clusters or combinations of statistically and/or conceptually related measures as predictor variables in the analysis. The method required a specified order of entry of the predictor variables so that the entry of each additional predictor was tested for its significance in explaining additional variance in salary above that of the previously entered variables (an incremental F-test).

Because my data set had several different measures for some of the compensable factors in the model, I decided to use this incremental "cluster" regression method to further analyze the data. The intent was to use the compensable factors from the model (i.e. their combined measures) as predictors in the regression analysis, thus having a tighter congruency between the model tested and the analysis tool utilized. Variable clusters (or compensable factors) were entered in the following order: 1) work-related prerequisites and corequisites; 2) work content and responsibilities; 3) type of institution; 4) work behaviors, i.e.

teaching, service, and research productivity; and lastly 5) gender. Because the purpose of the study was to test for sex discrimination, it was critical that gender was added last in the model so as not to inappropriately inflate its effects.

Using associate and assistant professors, the analysis revealed that all of the variable clusters except work behaviors (i.e. teaching, service, and research productivity) explained a statistically significant portion of additional variance in salaries. Gender had a significant effect even after the forced entry of all other predictors. The parallel analysis with assistant professors only revealed that gender was the **only** variable that explained a statistically significant portion of additional variance beyond that of all other predictors previously entered into the regression equation.

As anticipated, neither of these regression analyses explained more than 30% of the variance in salaries --- though this is not noticeably low compared to many studies of this type. Future research which includes some of the variables identified above could well increase the proportion of variance explained. However, it is doubtful that the inclusion of these variables (other than perhaps past administrative experience or salary) would alter the significant sex discrimination effect found in this study.

Closing Comments

I hope that I have illustrated why and how researchers make some of the decisions they do in the process of conducting their research. As I tell my doctoral students often, "There is no such

thing as a **perfect** study." Trade-off decisions must be made constantly ---- particularly in the design stage of research and sometimes, as the study above illustrates, even after data collection. The key in making these decisions is to understand what one is gaining or sacrificing in the rigor of the study ---- and further, to understand what these benefits or losses will mean in terms of the conclusions one can draw from the study's results.

ENDNOTES

1. Although these and other hallmarks of rigor are thoroughly addressed in many classic research methods texts, I have found that the Borg & Gall (1989) text is one of the more "user-friendly" for doctoral students conducting dissertation research. I would encourage students to explore more fully the explanations of these quantitative research considerations.

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